



ATMOSPHERIC SCIENCE

COLORADO STATE UNIVERSITY

2019 Newsletter

By plane and by ship, CSU researchers investigate atmospheric processes in collaborative campaigns

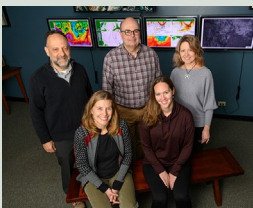


Colorado State University atmospheric scientists recently embarked on partner field campaigns to study weather phenomena over the Philippines and surrounding sea. The complex processes at play in this part of the world affect southeastern portions of continental Asia, and even weather in the United States. Ultimately, the observations CAMP²Ex scientists took by plane and PISTON researchers made by ship will improve weather and climate forecasts.

CAMP²Ex, the Cloud, Aerosol and Monsoon Processes Philippines Experiment, monitored the impact of smoke and pollution on cloud and aerosol processes. PISTON, or the Propagation of Intra-Seasonal Tropical OscillatioNs, observed how oceanic convective systems organize and evolve in the tropical atmosphere. The two international field teams conducting these studies will be able to compare findings for more comprehensive results.

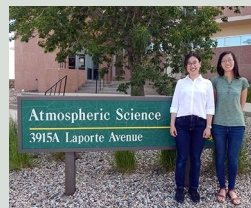
Continued on Page 14

Photo: A NASA P-3B science aircraft flies a CAMP²Ex mission over the CSU-designed-and-built SEA-POL radar aboard the R/V Sally Ride.
Photo by Brenda Dolan



AGU and AMS honor faculty with awards and fellowships

Pages 3-4



ASCENT scholarships fund grad students' international research

Page 16



AMS Alumni Reception

Please join us for the American Meteorological Society CSU Alumni and Friends Reception at the 100th Annual Meeting in Boston.

Tuesday, Jan. 14

6:30-8:30 p.m.

The Westin Boston Waterfront Hotel, Grand Ballroom C

Donate

Please consider supporting the Department of Atmospheric Science. Your gift strengthens CSU through the recruitment and retention of world-class students and faculty. It also ensures that our department will continue to be a leader in weather, climate, and air quality research.

To contribute, please visit: advancing.colostate.edu/ATMOS or call Beth Hallmark at (970) 491-3849.

Building a bright future on a solid foundation

As we reach the end of another year, it is our privilege to share with you a few glimpses into 2019's exciting activities here at CSU ATS. In the pages that follow, you can learn about some of the activities and accomplishments of our exceptional faculty, staff, students, and alumni.



Department Head
Jeff Collett

Continuing a trend from 2018, this was a year of extensive field campaign activity, such as our cover story feature on CAMP²Ex and PISTON. We completed a successful new faculty hire this year in the area of climate dynamics. Assistant Professor Maria Rugenstein, who received her Ph.D. from ETH-Zurich, will join the department in August 2020. Watch for a feature story on Maria in next year's newsletter.

The last decade has represented a generational change of a large fraction of the ATS faculty, along with some growth. With Maria's addition to an outstanding group of faculty members hired in recent years, the department will stand at 20 faculty, an all-time high. I am happy to point out that Maria's hire also increases to seven the number of women on the ATS faculty.

Our faculty and research staff continue to receive strong national recognition for their work; this year saw a new AGU Fellow (Sonia Kreidenweis); election of two new AMS Fellows (I was pleased to be elected, along with senior research scientist Paul DeMott); an AMS Meisinger Award (Libby Barnes); an AGU Macelwane Medal (Emily Fischer); and a new Foreign Member of the UK Royal Society (A.R. Ravishankara). A pretty good year!

We also continue to recruit exceptional graduate students into the program. Twenty new students entered our program in 2019. Our students continue to receive many accolades for their work (see p. 8). Speaking of students,

many of you know 1992 CSU ATS M.S. grad Jennifer Mahoney, currently serving as director of NOAA's Global Systems Division, who was selected as the 2019 CSU ATS Outstanding Alum (see p. 9). Competition for this award is especially keen. I encourage you to consider nominating a deserving colleague in 2020.

Last year, we highlighted plans to construct a new indoor/outdoor community space on the first floor of the original Atmospheric Science Building. I am pleased to report that construction on that space is now underway. We are excited to create a new space specifically designed to enhance interaction and collaboration across the department.

The department is pleased to continue supporting international research experiences for our students. In addition to those who join large field campaigns, we provide independent student travel opportunities to engage in collaborative research with leading scientists abroad. These opportunities (see p. 16) enhance the graduate student experience through development of international collaborations and immersion in a new culture. I am grateful to all of you who have donated to the ASCENT program that supports these experiences and encourage you to think about a new donation to ASCENT or to the department's discretionary fund that supports many activities throughout the year, including our annual AMS alumni reception. To contribute, please visit: advancing.colostate.edu/ATMOS.

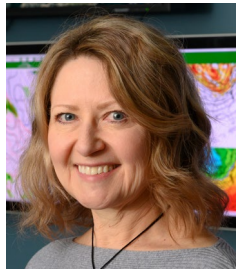
I wish you all the best in 2020. We look forward to seeing you at our AMS reception in Boston or on a future visit to Fort Collins.

Sincerely,
Jeffrey L. Collett Jr.
collett@colostate.edu

FACULTY NEWS

Sonia Kreidenweis named AGU Fellow

Already a fellow of both the American Meteorological Society and American Association for Aerosol Research, University Distinguished Professor Sonia



Kreidenweis has been admitted to yet another prestigious, exclusive scientific fellowship.

Each year the American Geophysical Union inducts no more than 0.1 percent of its membership as fellows. Valued by their peers and vetted by a committee of fellows, AGU Fellows are selected based

on their scientific eminence in the Earth and space sciences.

“Sonia has been a leader of the atmospheric chemistry program here at CSU

for more than 25 years,” said Department Head and Professor Jeff Collett. “She has been a terrific mentor to a large group of students and postdocs, many of whom have gone on to prestigious positions at other leading universities.”

Kreidenweis is well-known for

her research on atmospheric aerosol particles, their interactions with clouds, and their impacts on regional haze. Her research group conducts laboratory, field, and aircraft measurements to characterize the physical and chemical properties of aerosols. They study long-range dust transport and its effects on air quality and climate. Federal and state agencies that have contributed funding to their research include the National Science Foundation, Department of Energy, National Park Service, Environmental Protection Agency, National Oceanic and Atmospheric Administration, and NASA.

Emily Fischer receives AGU Macelwane Medal

In recognition of her significant contributions to the geophysical sciences as an outstanding early-career scientist, the American Geophysical Union has chosen CSU



atmospheric science Associate Professor Emily Fischer for the James B. Macelwane Medal. She will be honored at the AGU Fall Meeting in San Francisco in December for her breakthrough research on air pollution and her efforts to increase diversity in geosciences.

“The Global Burden of Disease ranks air pollution as the fourth largest health risk in the world.

... Knowing how much pollution comes from what sources for a given location, what are the pollutant properties, and how these pollutants are formed and evolve during atmospheric

transport are key pieces of information for reducing health risk. That is why atmospheric chemistry is such a cornerstone of science for improving human health – and this is where Dr. Fischer’s work is making a major contribution,” wrote UC Berkeley Professor Ronald Cohen in his nomination letter.

During the summer of 2018, Fischer led the largest, most

comprehensive research campaign ever attempted to analyze wildfire smoke. The National Science Foundation-funded **WE-CAN**, or Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption and Nitrogen, was a collaboration among five universities and the National Center for Atmospheric Research that involved a C-130 research plane loaded with scientific instruments. Analysis of the data collected during the campaign is ongoing and will shed light on the composition of wildfire smoke, how it changes over time and as it travels, and how it affects clouds. The results will bring insights on air quality, health impacts, weather, and climate.

Faculty & Staff Milestones (Years of Service)

5 years

Kelsey Bilsback
Amanda Davey
Erik Nielsen
Ilana Pollack
Yong Zhou

10 years

Rachel Storer

15 years

Henry Reges
Russ Schumacher
Zach Schwalbe

20 years

Ian Baker

25 years

Jeff Collett

30 years

Rick Taft

35 years

Graeme Stephens

40 years

Richard Johnson

45 years

Bill Cotton

FACULTY NEWS

Jeff Collett and Paul DeMott selected as AMS Fellows

Jeff Collett and Paul DeMott have been recognized by the American Meteorological Society for “outstanding contributions to the atmospheric or related oceanic or hydrologic sciences or their applications during a substantial period of years.” They will be inducted as fellows at the AMS Centennial Meeting in Boston in January.

“I am honored to have been nominated by my colleagues and appreciate AMS recognition of my work in atmospheric chemistry and air quality over the last three decades,” said Professor and Department Head Collett. “I have been



Jeff Collett



Paul DeMott

privileged to work with exceptional colleagues and many outstanding students over the years on a variety of topics ranging from cloud chemistry, to nitrogen deposition, to air quality impacts of unconventional air pollution sources

including wildfires and oil and gas development. I am especially pleased to be inducted as a new AMS Fellow together with Paul DeMott.”

“It means a lot to me to be recognized by my colleagues and by AMS in this way,” said senior research scientist DeMott. “AMS was my first-ever professional society, and the society supported my early career with travel grants and welcomed my participation on committees as a young scientist who was not in a tenured faculty position. I am thankful to AMS and those who promoted me for this designation.”

Elizabeth Barnes receives Meisinger Award for early-career research

In the short seven years since earning her Ph.D., Associate Professor Elizabeth (Libby) Barnes has made fundamental contributions to our understanding of the climate system. In recognition of her research on extratropical circulation and its response to climate change, Barnes will receive a highly competitive, national award from the American Meteorological Society at its Centennial Meeting in Boston in January. The Clarence Leroy Meisinger Award, given annually to an early-career researcher, acknowledges achievement concerning the observation, theory, and modeling of atmospheric motions on all scales.

“This is such an honor and honestly, a bit overwhelming!” said Barnes. “Looking at the past award recipients, I see that I am joining an already long list of past and present CSU stars!”

Among those stars is Department of Atmospheric Science Professor David Thompson, who received the Meisinger

Award in 2008. Thompson nominated Barnes for the award this year, along with several letters of support from her colleagues around the world.

“As the letter writers also attest, [Barnes’] research is highly creative, technically rigorous, and addresses problems of fundamental scientific and societal importance,” Thompson said. “The climate community in general – and CSU in particular – are lucky to include such a singular talent.”

Barnes’ research covers atmospheric dynamics and variability under different climates, including subseasonal-to-seasonal prediction of extreme weather and the impacts of anthropogenic climate change.



Wayne Schubert to be honored at AMS meeting

The American Meteorological Society will again recognize Professor Emeritus Wayne Schubert at



its Centennial Meeting in 2020 by holding a symposium in his honor. AMS named symposia acknowledge the contributions of the most distinguished members of the field.

AMS previously commended Schubert with the 2016 Jule G. Charney Medal, one of the organization’s top awards.

After 45 years with CSU’s Department of Atmospheric Science, Schubert has retired from teaching but continues to conduct research.

FACULTY NEWS



Emily Fischer chosen Professor of the Year

Department graduate student representatives chose Associate Professor Emily Fischer as 2018-19 Professor of the Year, based on evaluations submitted by students.

"Emily brings a tremendous energy and enthusiasm every day, and it is inspiring. One of the best professors I've ever had," graduate representative Ryan Gonzalez read from an anonymous nomination while presenting Fischer with a plaque at the New Student Welcome Picnic on Sept. 4.

Students praised Fischer's instruction methods and the applicability of her classes. One of the classes for which she was nominated was a one-of-a-kind Aircraft Observations course, where students planned flights and conducted research aboard the NSF/NCAR C-130.

"I thought, 'What would I like to do if I was a student?'" Fischer said of the experimental course. She requested extra flight hours from the National Science Foundation to conduct the class following her wildfire smoke research campaign, [WE-CAN](#).

Kristen Rasmussen recognized as outstanding graduate mentor

Colorado State University's Graduate Student Council has chosen Assistant Professor Kristen Rasmussen for this year's Graduate Advising and Mentorship Award. The award recognizes outstanding mentors around campus and honors their impact on students. Winners are selected based on nominations by CSU graduate students across all disciplines.



Rasmussen said she was surprised and honored to receive the award.

"I have wonderful students in my group and am very grateful for the excellent science they do every day," she said. "My approach to mentoring

includes providing students with a solid foundation in how to do research, including the 'big picture' perspective of why we do our work."

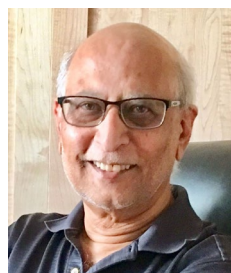
"[Rasmussen] is caring, supportive, and encouraging, both professionally and personally, which has fostered a really positive environment for her students," said Zach Bruick, a student in Rasmussen's research group. "I think that we all work better together because she leads by example so well."

Rasmussen recently led an [Advanced Studies Institute](#) program that enabled 16 students to participate in the RELAMPAGO field campaign in Argentina.

This is the second year Rasmussen was nominated in the three years she has taught at CSU.

Ravishankara elected Foreign Member of UK's Royal Society

University Distinguished Professor A.R. Ravishankara, who splits his time between the Departments of Chemistry and Atmospheric Science, has been named a Foreign Member of the Royal Society, the independent scientific academy of the United Kingdom.



ranks, in recognition of "exceptional contributions to science."

Ravishankara is a widely respected expert in the study of ozone, air quality, and climate change. Some of his recent research and

policy-related work has focused on reducing atmospheric pollution from developing countries, including India, whose cities are among the most polluted in the world.

This year, the Royal Society elected 51 scientists, 10 Foreign Members, and one Honorary Fellow to its

STUDENT AND STAFF NEWS

Welcome, new students!



Fall 2019 incoming students, front row, from left: Lilly Naimie (Colby College), Nick Falk (University of California, Davis), Justin Hudson (Tufts University), Wei-Ting Hsiao (National Taiwan University), Chih-Chi Hu (National Taiwan University), Allie Mazurek (University of Georgia, Athens), Chloe Boehm (Colby College), Eric Goldenstern (Valparaiso University), and Sam O'Donnell (University of North Carolina Asheville). Back row, left to right: Emily Lachenmayer (Quest University Canada), Megan Franke (Metropolitan State University of Denver), Ali Cole (Arizona State University), Lee Brent (Massachusetts Institute of Technology), Jacob Escobedo (Texas A&M University), Lance Niño (Cornell University), Chen-Kuang Yang (National Central University), and Sagar Rathod (University of Illinois). Not pictured: Jamin Rader (University of Washington) and Nick Geyer (Colorado State University).

College recognizes Kristen Rasmussen and Bonne Ford

The Walter Scott, Jr. College of Engineering honored Assistant Professor Kristen Rasmussen and research scientist Bonne Ford at its all-college meeting Nov. 4. Rasmussen received the George T. Abell Outstanding Early-Career Faculty Award, and Ford received the Outstanding Researcher – Rising Star Award. Award winners were selected by a committee composed of last year's winners. Nominations were submitted by colleagues and staff of the college's eight departments and programs.

"Kristen's contributions across research, atmospheric field campaign organization, mentoring, teaching, outreach, and



Kristen Rasmussen, left, and Bonne Ford. Photo by John Eisele

service in her first three years at CSU are without peer," wrote the three department professors who nominated Rasmussen. "In just three years as a professor, Kristen has already established herself

as one of the top rising stars in storms, precipitation, and extreme weather."

Ford's research group leader, Associate Professor Jeff Pierce, led her nomination, which was supported by colleagues inside and outside of the department.

"Bonne has made exceptional contributions not only to research, but also to student mentoring and management/leadership of two interdisciplinary WSCOE projects," he wrote in his nomination letter. "Bonne is an extremely gifted scientist, a highly effective project manager, and a caring and dedicated student mentor."

STUDENT AND STAFF NEWS

Congratulations, Atmospheric Science graduates!



Fall 2018 and Spring and Summer 2019 graduates who walked in commencement ceremonies May 17. From left to right, Marie McGraw, Samantha Wills, Ryan Riesenber, Erik Nielsen, Zach Bruick, Kai-Chih Tseng, and Michael Natoli. Photo by Sarah Tisdale

2019 Graduates

Student – degree – group

- Kevin Barry – M.S. – Kreidenweis/DeMott
- Steven Brey – Ph.D. – Barnes/Fischer
- Zach Bruick – M.S. – Rasmussen
- Kyle Chudler – M.S. – Rutledge
- Luke Davis – M.S. – Thompson
- Ryan Gonzalez – M.S. – Kummerow
- Faith Groff – M.S. – Schumacher
- Kirsten Mayer – M.S. – Barnes
- Marie McGraw – Ph.D. – Barnes
- Joe Messina – M.S. – Rutledge
- Michael Natoli – M.S. – Maloney
- Rob Nelson – Ph.D. – Kummerow
- Erik Nielsen – Ph.D. – Schumacher
- Ryan Riesenber – M.S. – Rasmussen
- Ben Toms – M.S. – van den Heever
- Kai-Chih Tseng – Ph.D. – Barnes/Maloney
- Samantha Wills – Ph.D. – Thompson

Ben Trabling and Kai-Chih Tseng receive department honors

Ben Trabling and Kai-Chih Tseng were honored April 19 for outstanding student publications. Trabling, advised by Associate Professor Michael Bell, received the Riehl Memorial Award for his paper, “Impacts of Radiation and Upper Tropospheric Temperatures on Tropical Cyclone Structure and Intensity,” based on his M.S. research. Tseng, advised by Professor Eric Maloney and Associate Professor Elizabeth Barnes, received the Alumni Award for an outstanding paper based on Ph.D. research for “The Consistency of MJO Teleconnection Patterns: An Explanation Using Linear Rossby Wave Theory.”

Herbert Riehl Jr. was in attendance for presentation of the Herbert Riehl Memorial Award that honors his father, who founded the Department of Atmospheric Science. Trabling and Tseng each gave brief technical presentations on their research following announcement of their awards.



Kai-Chih Tseng, left, and Ben Trabling with their Alumni and Riehl awards, respectively.

STUDENT AND STAFF NEWS

Student Fellowships, Awards, and Recognition

AGU Outstanding Student Presentation Award	Kathryn Moore
Alumni Award	Kai-Chih Tseng
AMS 18th Mesoscale Processes Conference first-place poster award	Peter Marinescu
AMS 18th Mesoscale Processes Conference second-place presentation award	Faith Groff
AMS 21st Conference on Atmospheric Chemistry Outstanding Student Paper Award	Will Lassman, Jakob Lindaas
American Meteorological Society Graduate Fellowship	Allie Mazurek, Jamin Rader (declined in favor of DOE Computational Science Graduate Fellowship)
AMS Outstanding Presentation Awards (for two different talks)	Ben Toms
AMS Summer Policy Colloquium	Jennie Bukowski, Kate O'Dell
Assisting Students, Cultivating Excellence, Nurturing Talent (ASCENT) Award	Jingyuan Li, Rung Panasawatwong, Kathryn Moore, Michael Cheeseman
Atmospheric Chemistry Colloquium for Emerging Senior Scientists (ACCESS)	Kelsey Billsback
David L. Dietrich Award	Jakob Lindaas
Department of Energy Computational Science Graduate Fellowship	Jamin Rader
Herbert Riehl Memorial Award	Ben Trabing
Hydrology Days third-place research presentation award	Erin Dougherty
National Atmospheric Deposition Program best student poster	Evie Bangs
NASA Earth Science Fellowship	Rick Schulte
NSF Graduate Research Fellowship	Kirsten Mayer
NSF Graduate Research Opportunities Worldwide (GROW)	Sean Freeman
Shrake-Culler Scholarship	Erin Dougherty
SoGES Global Sustainability Leadership Fellows	Kelsey Billsback, Jakob Lindaas

Jennifer Mahoney honored as 2019 Outstanding Alum

Department Head Jeff Collett presented Jennifer Mahoney with the 2019 Outstanding Alum Award in a ceremony Nov. 12. Collett noted that Mahoney recently was promoted to director of NOAA's Earth System Research Laboratory's Global Systems Division, shortly after the department committee made its selection. He joked that he liked to think they gave Mahoney a little boost toward her promotion, but if nothing else, her promotion was further proof of the quality of their choice.

Mahoney thanked the department for the award and gave a talk about "The Unimagined Path." One outcome she had never imagined was leading one of NOAA's premier scientific laboratories. "Mentors combined with motivation mixed with opportunity can lead to outcomes never imagined," she wrote in her abstract.

"Overcoming negativity, discouragement, and opposition to achieve my goals took personal courage and amazing scientific mentors. Many of those mentors were here at CSU," she stated.

Mahoney offered tips for early-career scientists and provided an overview of the cutting-edge scientific research underway at GSD. Located in Boulder, GSD is developing the next generation regional-to-global Unified Forecast System, Exascale-computing technologies, and next-generation decision-support tools that provide communities with actionable information.

Mahoney oversees more than 200 research scientists and engineers in her new role. She was part of the GSD management team that successfully developed and then transitioned the High Resolution Rapid Refresh model into operation. It is now the premier short-term forecast model used by NOAA and by the FAA for aviation weather, and one example from her extensive record of transitioning scientific advances into operations. She has received numerous awards during her career, including a 2016 NOAA Research Employee of the Year Award for Leadership.

Mahoney received her M.S. from the department in 1992. She was advised by Professor Tom McKee, who nominated her for the award. Her thesis was "Synoptic and Mesoscale Features in Colorado Winter Storms: A Climatology."

Satellite data assimilation, community-based numerical weather modeling, atmospheric chemistry, decision-support tools, cloud computing, and machine learning are just a few of Mahoney's areas of interest. She expressed a desire to build collaborations with department researchers on these topics.



A note from Mahoney:

I would like to express a sincere thank-you to the CSU Department of Atmospheric Science for recognizing me with the prestigious 2019 Outstanding Alum award. CSU is a respected University in atmospheric science, and I am proud to be part of its history.

As the Weather Enterprise changes and evolves, it becomes more imperative for institutions like CSU to remain at the forefront of leading-edge science and technology. NOAA and its laboratories depend on CSU early-career scientists to meet the mission and inform the laboratories with new skills and ideas. New collaborative tools and community software make it easier than ever to integrate science advancements that are taking place at CSU into research laboratories and operational centers. CSU is well poised to be a leader in the new Weather Enterprise.

To early-career scientists, I would offer these lessons learned. Take advantage of the opportunities that may come your way, even if it means leaving your comfort zone to try something new. Continuously prepare yourself for the next opportunity through continued education, training, and self-advocacy. Look for mentors who can guide you and provide perspective to help you make decisions. Above all, have the confidence and determination to work through the challenging times.

Again, I would like to thank the CSU Atmospheric Science Department for this outstanding award. I look forward to continued collaboration. Go RAMS!

Best regards,
Jennifer Mahoney

Updates from Alumni

Gus Alaka (M.S., '10; Ph.D., '14) was hired as an IT specialist at the Hurricane Research Division in NOAA's Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida, where he leads transitions from research into operations for the Hurricane Weather Research and Forecasting model and is a lead project scientist on board the WP-3D for NOAA's Hurricane Field Program. He flew several hurricane hunter missions into Hurricane Dorian as it approached the Bahamas.

Fred Alyea (Ph.D., '73) was recognized by the United Nations Environment Programme for his contributions to the 2007 Nobel Peace Prize won by the Intergovernmental Panel on Climate Change and Al Gore. The Nobel citation for the IPCC praises two decades of scientific reports that have "created an ever-broader informed consensus about the connection between human activities and global warming."

Trent Davis (M.S., '18) is employed at the NWS Philadelphia/Mount Holly office. He recently published the paper, "[Lightning Location, NOx Production, and Transport by Anomalous and Normal Polarity Thunderstorms](#)" from his thesis with Professor Steven Rutledge. He also has been working with the Integrated Decision Support Services team at his office and helped lead a weather and communications workshop with local broadcast meteorologists and emergency managers.

Pat Fitzpatrick (Ph.D., '95) is the Atmospheric Science Program coordinator for Texas A&M University-Corpus Christi. This new program will yield its first graduates this year. He also continues his tropical cyclone applied research.

Jim Fleming (M.S., '73) was a keynote speaker at the 100th anniversary meeting of the International Association of Meteorology and Atmospheric Science in Montreal. He is an adviser to "Making Climate History" at the University of Cambridge.

Bob Grossman (M.S., '68; Ph.D., '73) has moved to the San Miguel Basin after more than 50 years on the Front Range, where he led the effort to make Norwood the Western Slope's first Dark Sky Community (second in all of Colorado). He published an article in *BAMS* on reservoir evaporation in January 2018 and is still active in southwestern monsoon meteorology.

Stacey Hitchcock (Ph.D., '18) is a postdoctoral research fellow with the Australian Research Council's Centre of Excellence for Climate Extremes and the School of Earth Sciences at the University of Melbourne in Melbourne, Australia. Her research aims to improve understanding of the processes that support extreme rainfall in organized deep convection, with a specific emphasis on linear systems that frequently impact Melbourne and the surrounding region.

Timothy Lang (M.S., '97; Ph.D., '01) led NASA instrument deployments in three recent international field campaigns: Propagation of Intra-Seasonal Tropical Oscillations (PISTON, 2018), Remote sensing of Electrification, Lightning, and Mesoscale/microscale Processes with Adaptive Ground Observations (RELAMPAGO, 2018-19), and Cloud, Aerosol and Monsoon Processes Philippines Experiment (CAMP²Ex, 2019).

Landan MacDonald (M.S., '15) recently completed medical school at Dalhousie University and started his urology residency in Halifax, Nova Scotia. He is loving surgery but misses Fort Collins and the atmospheric science department.

Joel Martin (M.S., '88) remains a practicing operational meteorologist. He was a career U.S. Air Force officer who served with the Flying Tigers Hurricane Hunters and the Mighty Eighth Air Force. He retired from active service as a colonel in 2003. He was awarded the American Meteorological Society's top public service award, the Francis W. Reichelderfer Award, in 1990. He and his wife Elizabeth are now semi-retired in Norman, Oklahoma.

Updates from Alumni

Annareli Morales (M.S., '14) earned her Ph.D. from the University of Michigan in August 2019 and began an Advanced Study Program postdoctoral fellowship at NCAR in Boulder. She works jointly with the Research Applications Lab and the Mesoscale and Microscale Meteorology Lab to study precipitation over mountains.

Rob Nelson (M.S., '15; Ph.D., '19) is a postdoctoral fellow at NASA's Jet Propulsion Laboratory, working on the Orbiting Carbon Observatory-2 and Orbiting Carbon Observatory-3 missions.

Walt Petersen (M.S., '92; Ph.D., '97) recently was appointed deputy chief of the NASA Marshall Space Flight Center Science Research and Projects Division. The NASA Marshall SRPD maintains a science research portfolio in the astrophysics, heliophysics, planetary, and Earth science disciplines.

Anita Rapp (M.S., '04; Ph.D., '08) has been promoted to associate professor with tenure in the Department of Atmospheric Sciences at Texas A&M University. Her research group is currently working on several projects, including a new NASA Earth Venture Suborbital-3 project focused on the Dynamics and Chemistry of the Summer Stratosphere, as well as NASA Energy & Water Cycle Study and Precipitation Measurement Missions projects to better understand cloud-precipitation-radiation interactions in the tropics and subtropics.

Joseph Rogash (M.S., '82) is currently a senior forecaster at the NOAA National Weather Forecast El Paso office and has completed more than 35 years of federal service as a meteorologist. He also has been involved with flash flood studies associated with the summer monsoon over the southwestern United States.

Angela Rowe (M.S., '07; Ph.D., '11) will be an assistant professor in the Atmospheric and Oceanic Sciences department at the University of Wisconsin-Madison, beginning January 2020.

Kira Shonkwiler (Ph.D., '18) was appointed as one of two emission inventory specialists for Colorado's Air Pollution Control Division in Denver in January. She uses research, policy, and professional collaboration and judgment to build scientifically sound emissions inventories for official purposes in rule-making, federal compliance, and the development of national modeling platforms.

Roger Stocker (M.S., '96) was chosen as the new Mesoscale Modeling Division head at the Navy Fleet Numerical Meteorology and Oceanographic Center in Monterey, California, where he has worked for more than 20 years.

Doug Stolz (Ph.D., '16) has continued lightning-related research with Professor Steven Rutledge and the CSU Radar Meteorology group and has been running a weather consulting/contracting business, Cross Product Atmospheric LLC in Seattle. In the past year, he has worked as a natural hazards awareness training instructor with the National Disaster Preparedness Training Center.

Elizabeth Thompson (M.S., '12; Ph.D., '16) is a federal employee at NOAA Earth System Research Laboratory in Boulder. She is a research meteorologist on the Boundary Layer Observations and Processes Team, where she leads and contributes to several projects on tropical air-sea interaction, physical oceanography, and weather and climate processes.

Pete Wetzel (M.S., '73; Ph.D., '78), who retired from NASA in 2005, this year completed his goal of walking to every place he has ever lived, concluding in Fort Collins, after covering more than 18,000 miles over nine years. You can [read about his journey on CSU's Source news website](#).

Climate Center establishes 3 new state records in 2019

Update from Colorado Climate Center Director Russ Schumacher.

2019 brought some wild weather to Colorado, and the Colorado Climate Center worked to establish three new state records, for maximum temperature, hailstone size, and low pressure.

A State Climate Extremes Committee, including staff from our office as well as the National Weather Service and the National Centers for Environmental Information, convened for the temperature and hail records.

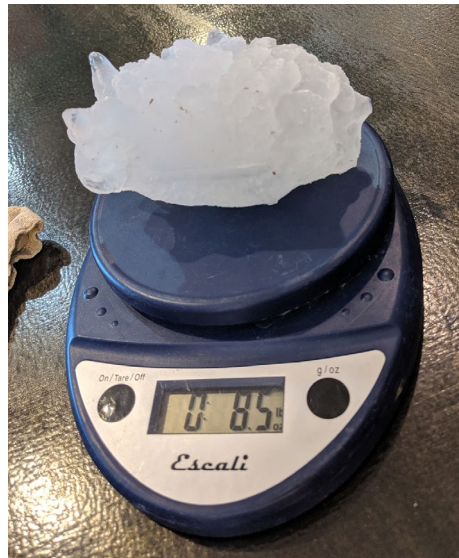
To verify the hailstone record, we traveled to Bethune in eastern Colorado, where large hail fell from a supercell storm on Aug. 13. Fortunately, a family preserved the stone in the freezer within about 30 minutes of when it landed, meaning that it was certainly even larger when it fell than when we measured it. We measured the largest stone as having a diameter of 4.83 inches, which surpassed the long-standing record of 4.5 inches. The hailstone weighed 8.5 ounces.

A few days later, the Insurance Institute for Business and Home Safety made a 3-D laser scan of the hailstone, allowing for future study. The hailstone now resides in the lab at NCAR in Boulder, but we have several 3-D-printed models of it, so if you stop by the Climate Center, you can see one!

Confirming the temperature record was more complicated. On July 19, a temperature of 115 degrees Fahrenheit was reported at John Martin Dam in southeastern Colorado, between Las Animas and Lamar. (The existing record was 114 degrees Fahrenheit, set at Las Animas in 1933 and Sedgwick in 1954.)



Climate Center staff, from left to right, front row: Noah Newman, Becky Bolinger, Dani Talmadge, Steve Hilberg, and Henry Reges. Back row, from left: Russ Schumacher, Julian Turner, Peter Goble, Nolan Doesken, Alistair Vierod, and Zach Schwalbe.



Colorado's record hailstone weighed in at 8.5 ounces.

However, the temperature was recorded on a thermograph with a paper chart that only went up to 110! Therefore, we conducted tests in a laboratory oven at CSU to confirm that the thermograph operates properly at such high temperatures, and we confirmed that the

new record temperature was valid.

During the intense "bomb cyclone" in March, the air pressure dropped rapidly across much of eastern Colorado. The pressure, adjusted to sea level, reached a low of 970.4 millibars at Lamar on March 13. Pressure records have not been tracked as closely over the years as temperature or precipitation records, but a thorough sweep of available data indicated that the pressure readings during the March storm were at least a few millibars lower than any that had been recorded in past storms, and thus we were confident in declaring this a record as well. This storm, with blizzard conditions causing major travel disruptions, also set records for wind gusts at several stations.

Establishing these records was just one aspect of the CCC's work in 2019 toward achieving our mission of serving Colorado by providing climate monitoring, climate research, and climate services.

RESEARCH

NOAA renews \$128M research partnership with CIRA

One of the nation's most influential atmospheric science-oriented research institutes, based at Colorado State University, has been awarded a new \$128 million cooperative agreement with the National Oceanic and Atmospheric Administration.

The Cooperative Institute for Research in the Atmosphere, known as CIRA, supports a broad spectrum of NOAA research, including forecast model

improvements, hurricane track and intensity forecasting, real-time satellite tools for the National Weather Service, and forecaster training on use of satellite observations.

Established in 1980 as a partnership between CSU and NOAA, CIRA is among just 16 cooperative institutes at premier centers of research excellence across the country. It is led by atmospheric science Professor Christian Kummerow and was

founded by University Distinguished Professor Tom Vonder Haar.

Meteorologists around the country rely upon NOAA satellite imagery and forecast models supported by CIRA on a daily basis. CIRA researchers make the connection between forecast models and real-time weather and climate observations, leading to better forecaster awareness and guidance to decision-makers and the public.

ATS researchers find clues to climate change in the dust

Clouds tell us what type of weather to expect and wield a great deal of influence over our climate. They can enhance warming by trapping heat or cool the planet by reflecting sunlight back into space. Atmospheric scientists are studying another influencer with outsized effect: dust.

Dust can transform clouds, thereby altering the climate. With global temperatures rising and glaciers receding, the Arctic has been getting a lot dustier lately.

"As the Arctic climate changes, and the land/ocean surface properties change, impacts of particle emissions on cloud properties need to be considered as part of the story," explained Paul DeMott, one of the Colorado State University atmospheric scientists who recently participated in an international study of glacially sourced dust and its impact on cloud formation. Their findings were published in *Nature Geoscience* on March 25.

This study, led by former CSU researcher Yutaka Tobo, was among the first to consider dust originating in the Arctic, rather than from the usual suspects, arid and semi-arid regions.

As glaciers melt, dust is left in their wake. Some of this dust is picked up and lofted high in the atmosphere, where it can act as the foundation for ice crystal formation in clouds. Icy clouds are less reflective than water-based clouds, which scatter more light back to space. These "glaciated" clouds also are more susceptible to precipitation, which shortens their life span and modifies the hydrological cycle.

To determine the origin of these ice-nucleating particles, researchers took soil and particle samples in glacial outwash



Jun Uetake, left, and Yutaka Tobo install sampling lines for particle collection at a research station in Svalbard, Norway.

plains in Svalbard, an archipelago in the Arctic Ocean between mainland Norway and the North Pole. Lab experiments then assessed the composition and freezing properties of collected particles and soils.

Researchers did not expect to find such high activity of biogenic ice-nucleating particles in soil with such low organic content, but the results explain the observed increase in particles capable of seeding ice and precipitation formation in clouds in Svalbard's air during summer.

"It surprised me that what would be considered poor soils were so full of these special particles that come originally from biological processes," DeMott said. "It also surprised me that high latitude dust sources can dominate over transports from other major global dust sources at certain times of the year, yet have been largely ignored."

RESEARCH

Collaborative campaigns, continued from cover

CAMP²Ex originally was scheduled to take to the sky in 2018, but the campaign had to be delayed a year due to aircraft issues. Once off the ground, flight scientist and Professor Susan van den Heever and her crew aboard the NASA P-3B science aircraft collected a wealth of data that will enhance our understanding of aerosol and cloud processes.

“The campaign was a tremendous success,” van den Heever said. “We flew 19 P-3 science flights. We obtained observations of shallow maritime cumulus clouds, deeper congestus clouds, tropical linear cloud systems, and cold pools within polluted and clean environments, allowing us to examine the impacts of aerosols on these cloud types and processes.”

Industrial growth in Southeast Asia has led to changes in atmospheric composition and precipitation. Biomass burning in Malaysia and Borneo produces smoke, while China creates large quantities of sulfates and other pollution, and the urban center of Manila also yields high concentrations of aerosols. All of the resulting particles filling the air influence cloud processes, precipitation, and how incoming solar radiation interacts with clouds and the surface. CAMP²Ex’s three-part mission is to examine the impacts of aerosols on cloud processes, precipitation, and radiation; the way in which the atmospheric environment alters these impacts; and how clouds subsequently affect the aerosols.

To accomplish these goals, a suite of remote-sensing and in-situ instruments on board NASA’s P-3 and a SPEC Inc. Learjet measured the microphysical and chemical properties of clouds as the aircraft passed through, below, above, and around them. Scientists aboard the P-3 dropped almost 200 dropsondes from the tail of the plane to measure vertical profiles of temperature, moisture, and wind.

“We are hoping that this vertical characterization of the environment will help us to better understand the role of temperature, moisture, and wind shear in controlling or modulating aerosol-cloud interactions,” van den Heever said.

Meanwhile, the R/V Sally Ride, a U.S. research vessel operated by Scripps Institution of Oceanography, complemented the aircraft observations from below. As the ship steamed around the Pacific Ocean east of the Philippines, its crew of scientists measured air and sea interactions using radiosondes launched via weather balloons and the SEA-POL C-band polarimetric radar, designed and built at CSU under the direction of



From left, Alex Sokolowsky, Susan van den Heever, and Sean Freeman in front of the NASA P-3B science aircraft used for the CAMP²Ex field campaign. Photo by Andrzej Wasilewski

Professors Steven Rutledge and V. Chandrasekar.

“Our interest is in documenting the evolution, organization, and diurnal cycle of convection in relation to larger-scale variability in the tropical atmosphere,” said research scientist Brenda Dolan, who oversaw atmospheric operations for the Sally Ride. “We are able to do this at very high spatial and temporal resolution with the SEA-POL radar.”

Dolan coordinated missions with the CAMP²Ex flight scientists as they flew around the Sally Ride. Associate Professor Michael Bell’s research group provided daily weather forecasts for PISTON, while graduate student Sean Freeman did the same for CAMP²Ex, ensuring both ship and plane collected the best data and steered clear of typhoons.

Soundings launched from the ship eight times a day characterized the atmospheric thermodynamic state, while dual-polarized measurements taken with SEA-POL provided insights into the growth processes of convective cells. These PISTON observations, made by Professor Rutledge’s research group, offer context for CAMP²Ex’s research.

“Such co-located datasets allow us to obtain better observations near the surface and aloft, and are tremendously valuable in enhancing our understanding of aerosol and cloud processes, as well as evaluating these processes in numerical models,” van den Heever said.

[Read the full story on CSU’s Source news website.](#)

DEPARTMENT NEWS

ATS team works to prevent sexual harassment in the field

Scientists involved in a field campaign are away from their normal routines, offices, and universities, including the support mechanisms available if sexual harassment or other inappropriate behaviors occur. Three Colorado State University researchers are examining the prevalence of sexual harassment in field-based research as part of a National Science Foundation-supported study.

The CSU team, which includes Emily Fischer, Kristen Rasmussen, and Brittany Bloodhart, are also studying what psychological indicators might lead people to engage in – or intervene in – a harassment situation.

Part of their work is documenting how people respond when the issue of sexual harassment is openly discussed and expectations for professional behavior

are clearly set by team leadership. The goal: creating a policy and culture of collegiality and respect across field teams.

Their efforts are supported by nearly \$300,000 from the National Science Foundation, awarded last year. The group used two recent CSU-led field campaigns as test cases and proving grounds for their project.

Inspiring young scientists: ATS hosts 108 second-graders

There was a little extra excitement at Atmos on March 29. In addition to hosting five prospective graduate students, the department welcomed 108 second-graders from Altitude Elementary in Aurora. Young minds delighted in scientific discovery as the children rotated through several stations designed to teach them about precipitation, air pollution, and weather and climate.

Noah Newman, outreach coordinator for the Colorado Climate Center, discussed the water cycle with the students and reviewed what they knew about the atmosphere and how it protects us. They finished the station with a hands-on demonstration on how meteorologists measure three forms of precipitation: rain, hail, and snow.

“All of the students did really well with answering the questions I posed to the classes, and they had many good questions and comments of their own,” Newman said. “Overall, it was a really fun day.”

FORTCAST volunteers and grad students Sean Freeman, Jennie Bukowski, and Kyle Chudler ran several interactive



Drone pilot Sean Freeman, right, took this aerial photo of the visiting second-graders from Altitude Elementary.

demonstrations that enthralled the schoolkids while teaching them about clouds, colors and heat absorption, air pressure, and using drones for research.

At another station, research scientist Katie Benedict taught the students about air pollution. They learned about particles in the atmosphere and how our noses and lungs filter those particles and protect our bodies. Research scientists Arsineh Hecobian and Amy Sullivan also led demonstrations of smells from volatile organic compounds and the use of chromatography to separate a mixture of chemicals, in this case water-soluble marker colors.

The visit culminated in a weather balloon launch and drone flight. Despite the dreary weather, the youngsters exclaimed in enthusiasm as the balloon was released, and more than 100 little faces watched intently as it drifted higher into the clouds until it was out of sight. For the grand finale, drone pilot Sean Freeman gave a much-anticipated flight demo of the drone’s maneuvering capability and snapped a few aerial shots of the enrapt second-graders. The kids cheered as the drone settled back on the ground. After a unified “thank-you” on their teachers’ cue, the second-graders boarded their buses, likely taking with them lessons they won’t soon forget.



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The *Atmospheric Science Newsletter* is published annually for alumni, friends, and members of the department. Please send alumni news, comments, questions, corrections, and address updates to: info@atmos.colostate.edu, or call (970) 491-8682.

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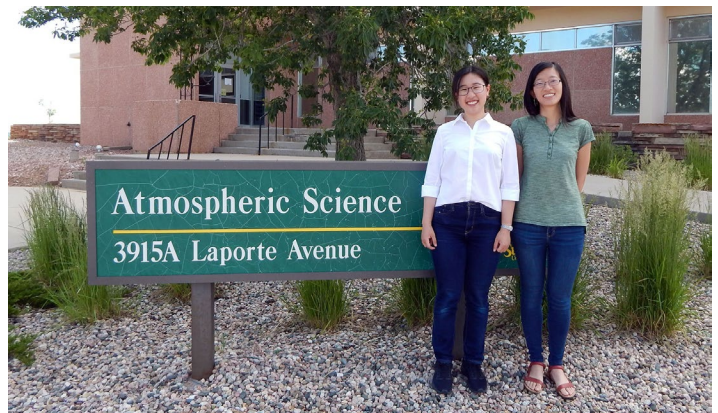
DEPARTMENT NEWS

ASCENT scholarships fund international research trips

Four atmospheric science graduate students received scholarships this year from a department fund established to enrich the graduate experience. Jingyuan Li, Rung Panasawatwong, Kathryn Moore, and Michael Cheeseman all are applying their Assisting Students, Cultivating Excellence, Nurturing Talent awards to international research opportunities.

Li, a Ph.D. student in Professor David Thompson's research group, used her funding to travel to Bergen, Norway, for two months this fall to work in large-scale atmospheric dynamics at the University of Bergen Geophysical Institute and the Bjerknnes Centre for Climate Research, two of the top climate institutes in the world.

"My experience has been great – meeting new people, sharing ideas, presenting my work, and getting exposed to the



Rung Panasawatwong, left, and Jingyuan Li are two of the four ASCENT scholarship recipients this year.

research being done in Bergen," Li said. "This will be greatly beneficial in my Ph.D. research."

ASCENT grants are funded by donations to the program. Read about all of the projects on the department website.